CLAMP FOR AUTOMATED WELDING INSTALLATIONS

FIELD OF INVENTION

[0001] The present invention relates to automated welding installations, adding some important improvements to the presently known apparatus

[0002] . More specifically, the present invention is intended for automatic welding installations for automobile bodies with robotic grips and tools which have numerous clamps to hold two or more sheets during spot or arc welding in a mobile or static process.

BACKGROUND OF THE INVENTION

[0003] Clamps are vital elements in automatic welding installations since the design and operations of the welding installation depend to a great extent on the characteristics of the clamps, in particular, the accuracy of activation, the dimensions, and the ease of assembly and dismantling during installation and maintenance.

SUMMARY OF THE INVENTION

[0004] The clamp of the present invention is designed to obtain numerous improvements over the presently known clamps for the same function. Among these improvements are the following:

[0005] simplification and saving in the construction of the body of the clamp which has a central calibrated tube and lateral plates cut with a laser beam, thereby avoiding complex, high-cost machining of the body of the claim from rolled steel;

[0006] reduction in transverse dimensions of the entire clamp by eliminating lateral or external arms and providing fixed mobile arms supported in a housing having a position sensor for the mobile arm using a mobile metal bend;

[0007] higher precision in detecting the angular position of the mobile arm by feedback from the detecting elements;

[0008] greater protection against welding spattering on all sides of the clamps and, in particular, protection of the movement of the arm by a mobile metal band associated with the arm itself which slides over a circular slot of the housing to cover all movement of the clamping arm;

[0009] reduction of the transverse dimensions of the clamp by use of a central arm instead of lateral arms enabling decrease of the transverse dimensions form 62mm of the presently known clamps to 42mm of the clamps of the present invention;

[0010] reduction in the diameter of the pneumatic cylinder used for activating the clamp, for example from the presently used 40mm diameter cylinder to a 32mm diameter cylinder in the clamps of the present invention;

[0011] easier assembly and dismantling of the clamp assembly by special centering arrangement on the support for the clamp assembly; and

[0012] reduction in energy consumption of the clamp by almost 50% to effect a significant saving in the operation of the welding installation.

[0013] In another embodiment of the present invention, the clamp has a single body mounting the lower end of the cylinder and the upper end of the mounting carrier of the fastening point. The carrier has guides for the actuating element for the clamping arm and provides an extreme opening in which the arm is fitted. This embodiment eliminates the exterior closings of the principal embodiment.

[0014] In this embodiment, the rod of the piston has an activator which acts on an elongated hole of the arm, causing the arm to turn and are assembled with needle bearings that journal guides with a half rod section.

[0015] The present invention may also provide needle bearings on the lateral sides of the clamp assembly which are mounted in orifices and project from the orifices to allow easy and rapid centering of the tools when the clamp is assembled to the welding machine, thereby providing easy assembly and dismantling of the clamps for replacement of parts, maintenance, and other purposes by reason of the direct and immediate recovering of the centering position.

[0016] These and other advantages and specific examples of the present invention are more fully set forth hereinafter with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 shows a transverse sectional view of a first embodiment of the present invention in fully closed position with the portion encircled in FIG. 1 shown separately at an enlarged scale;

[0018] FIGS. 2, 3, 4 and 5 each are sectional views taken on the lines II-II, III-III, IV-IV and V-V;

[0019] FIG. 6 is a sectional view similar to FIG. 1 showing the apparatus with the clamp in a fully open position;

[0020] FIG. 7 is a view similar to FIG. 1 illustrating a pneumatic shock absorber at the upper end of the assembly;

[0021] FIG. 8 is an enlarged sectional view of the upper portion of FIG. 7; and FIGS. 9 and 10 are sectional views illustrating operation of the shock absorber shown in Fig. 7;

[0022] FIGS. 11, 12 and 13 are exploded views showing the assembly of the fixed mobile arms to the body of the clamping assembly;

[0023] FIG. 14 is an exploded view showing the assembly of the lateral plates and the protection metal band;

[0024] FIG. 15 is a perspective view of FIG. 14 assembled alone with a center device;

[0025] FIG. 16 is a view similar to FIG. 15 showing the center device assembled at the rear of the clamp assembly;

[0026] FIGS. 17, 18 and 19 are perspective views of a special fastening and centering bracket for mounting the clamping tool on a grip or other element of a welding tool;

[0027] FIG. 20 is a perspective view of another embodiment of a clamping tool with a mobile arm;

[0028] FIG. 21 is a view similar to FIG. 20 showing another mobile arm;

[0029] FIG. 22 shows an elevational view partially broken away showing elements associated with the mobile arm of FIG. 20;

[0030] FIGS. 23 and 24 are longitudinal sectional views of a clamp assembly with the mobile arm of FIG. 21 in open and closed positions respectively;

[0031] FIGS. 25, 26 and 27 are transverse sectional views taken on the lines XXV, XXVI and XXVII, respectively, of FIG. 24;

[0032] FIGS. 28 and 29 are sectional views similar to FIGS. 23 and 24 showing a clamping assembly with double mobile arms;

[0033] FIGS. 30, 31 and 32 are transverse sectional views taken on the lines XI, XII and XIII, respectively, of FIG. 29;

[0034] FIGS. 33 and 34 are elevational views similar to FIG 22 showing a mobile arm in two positions and showing the positions of orifices which serve as receptacles for the centering guide bushings; and

[0035] FIG. 35 shows a transverse section taken on the line XVI-XVI of FIG. 34.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0036] Referring to FIGS. 1-19, the clamping jaw assembly comprises a single body 1 made with a steel tube which is calibrated and two lateral plates 2 and 3 (see FIG. 11) which are cut from a plate, preferably with a laser beam, which is calibrated so that these lateral plates achieve a high dimensional precision and therefore can be joined by welding to the central tubular element 1 as seen in FIG. 12. The plates 2 and 3 have openings for the purpose of lightening the components and additional vertical openings for guiding a roller 17 which is activated by an extension 18 of the piston rod to displace the lower arm 7, as described later.

[0037] As seen in FIG. 13, the clamp has an upper fixed arm 4 which is joined to the plates 2 and 3 with split pins or screws 5 and 6, and a lower mobile arm or L-shaped arm 7

which bears a removable mounting 8. The upper arm 4 and the mounting 8 have screws 10 and 9, respectively, which are intended to clamp the sheets to be welded. The screws can be of any type desired, and in the drawing, each screw is provided with a ball and socket joint 12 and 11 which allow auto alignment of the screws in relation to the sheets being clamped.

[0038] The L-shaped arm 7 pivots on a transverse pivot shaft 13 (see FIG. 11) which spans between the plates 2 and 3.

[0039] The L-shaped mobile arm 7 has a shaped elongated hole 16, as explained below. In this elongated hole, the roller 17 is displaced by the lower extension of the piston rod 18, which, in turn, is actuated by the assembly including the cylinder 19, and the pneumatic piston 20 which are lodged in the tubular body 1. As shown in FIGS. 9 and 10, the piston rod 18 is assembled to the piston 20 at its upper end.

[0040] The upper end of the cylinder 19 is closed by a cover 21 and has a receptacle 39 for receiving an upper extension 38 of the piston rod in order to form a pneumatic shock absorber as described below.

[0041] The lateral plates 2 and 3 are calibrated with a high quality surface finish so that the lightening openings and the roller openings may be closed by means of a lateral cover 22 for the plate 2 and cover 23 for the plate 3. The covers adapt and are fixed to the external surface of the plates 2 and 3 with, for example, screws as the ones 24, 25 and 26.

[0042] The space between the plates 2 and 3, after mounting the covers 22 and 23, is covered on the lower side by a metal band 27 and secured by screws as shown in FIG. 14. The band 27 has an elongated window 28 so that welding spatterings and other foreign bodies are prevented from entering the space between the plates.

[0043] The mobile arm 7 is activated by the action of the piston rod between the closing position shown in FIG. 1 and the complete open position shown in FIG. 6. The activation roller 17, which is joined to the lower end of the piston rod 18, acts inside a shaped elongated hole 16 (see FIG. 6) which presents a gently curved upper area 30 and a straight inferior area 31 so that when the piston rod moves, the contact point of the roller 17 with the elongated hole 16 of the mobile arm makes the arm turn on the pivot shaft 13 while the angle of incidence

progressively decreases and the component on the arm grows in proportion and magnitude. The straight area represents an irreversibility area because of the shape of the elongated hole 16 (see FIG. 1) so that the roller cannot transmit any vertical component. This prevents the arm from opening even when subjected to an external force. The irreversibility resulting from the affect of the roller 17 in the opening 16 is also achieved in the absence of stress on the piston rod because of the action of the pneumatic cylinder.

[0044] Activation of the piston rod 18 takes place as explained above because of the action of the assembly of the cylinder 19, and the pneumatic piston 20. The cylinder 19 constitutes an internal casing of the cylindrical body 1. Between the body 1 and the cylinder 19 inside of which the piston 20 and piston rod 18 slides, there is a space 32 which permits the passage of air. As shown in the enlargement detail of FIG. 1, the spacing 32 is used as a passage for air that will act on the lower side of the piston 20 by allowing air to pass through the orifice 33 of the cylinder 19. The cylinder 19 has a lower cover 34 which is fitted into its lower end and provides a groove for the reception of a sealing O-ring 35.

[0045] The upper cover 21 presents the receptacle 36 that receives the upward extension 38 of the screw 37 fastening the piston to the piston rod 18, the screw head 38 serving as an upward extension of the piston rod which may be used to function as a shock absorber at the upward stroke of the piston. The shock absorber is formed by the upward extension 38 of the screw engaging in the top 39 of the receptacle 36, which is shown in FIG. 8, and has a small orifice connecting the top 39 to an outlet 42 in the cover. A sealing gasket 40 on the lower part of the receptacle 36 seals the upper end of the cylinder. Above the seal 40, the outlet 42 is connected by a lateral passage 41 to the receptacle 39. As shown in FIG. 8, on the opposite side of the cover, a lateral orifice 45 connects a cavity 43 of the cover with the space 32 between the cylinder 19 and the body 1.

[0046] It was of great importance to detect the positions of the arm for synchronization and control of the clamping assembly and also to detect if the clamps work. This detection is carried out with sensors 46 (see FIGS. 15 and 16) at the rear of the clamping assembly. This mounting is very important when designing welding tools since it makes possible to assemble a higher number of clamping assemblies within a given space. With this position of the sensor, it

is possible to detect the arm through its movement using the mobile metal band 29 which provides a more accurate reading of the signal and thus locates the angular position of the arm with more precision.

[0047] Another essential characteristic of the present invention lies in the manner of fastening the assembly to the frame of the mechanism of a grip or welding tool. According to the present invention, it is possible to re-establish the correct position of the assembly in relation to the grip or welding tool after the assembly has been dismantled for replacement, repair or other purposes. As shown in FIGS. 18 and 19, the clamping assembly, designated 47, has a fastening bracket 48. This bracket 48 mounts the clamp assembly to the grip or welding tool presented by a bar or tube 49. In this case, proper centering is provided by a recess 50 (see FIG. 17) providing a shoulder 51 of the bracket 48 which fits in upper corner 51 of the assembly 47, for example the corner 52 shown in FIG. 19.

[0048] In the embodiments of the invention shown in FIGS. 20-35, the clamp assembly has a body that is cylindrical in its lower part 101 and has a square straight prismatic shape 102 in the upper part. The upper part has a wide transverse opening 103 that is open to the upper side. A turning arm 104 is fitted inside this opening 103 between the opposite sides of the casing which functions similar to the plates 2 and 3 of the first embodiment. The assembly is closed at the topside so that welding spatterings and other foreign material is prevented from entering the body of the assembly, eliminating the need for closure elements for that part of the assembly.

[0049] The mobile arm 104 extends outwardly with a front extension 105 having centering orifices 106 and 107 which permit the assembly of accessories and couplings to it.

[0050] In FIG. 21, the arm 104 is reversed and modified with a different front 105 and centering orifices 106 and 107 and is movable between clamping and opening positions shown in FIGS. 23 and 24.

[0051] FIG. 22 shows the embodiment of FIG. 20 with clamping accessories 108 and 109. The accessory 108 is placed on the front extension 105 of the mobile arm 104 above a bracket 110 on the front side of the body. On the lateral sides of the body 102 and on the

upper side of the extension 105 of the arm 104, receptacles are provided for receiving projecting guide bushings such as 111 and 112 (FIG. 22) for the upper and lower clamps 108 and 109. These bushings 111 and 112 make it possible to center the accessories 108 and 109. The accessories 108 and 109 have hollows which match up with the projecting parts of the guide bushings. Thus, it is possible to re-assemble the accessories 108 and 109 bearing screws 113 and 114 after they are dismantled for replacement of parts, maintenance or other purposes. In FIG. 22, there are two clamp screws 113 and 114, respectively, although it should be appreciated that the number and positions of the screws may be varied.

[0052] FIGS. 23 and 24 illustrate the double-effect piston 115 within the body 101 with the piston rod extension 116 which moves inside a cylinder 117 having a lower cover 118 similar to the cover 21 of cylinder 19 which has the pneumatic shock absorber effect. The cover 119 provides sealing elements for the piston rod 120 which projects upwardly with an extension having openings 128 for a shaft 123 which slides along these openings within needle bearings 124 and 125 (see FIG. 25).

[0053] In FIG. 26, the upper part 102 has two transverse bores 129 and 130 which are straight. These bores 129 and 130 receive screws, such as screws 131 (FIG. 22) to fasten the accessories to the body. The bores are undercut at the ends 132 and 133 to receive centering guide bushings 112 shown in FIG. 22.

[0054] FIGS. 28 and 29 illustrate a clamping assembly similar to the assembly shown in FIGS. 23 and 24 with two mobile arms 134 and 135 actuated by the shaft 123. These two arms 134 and 135 are displaced in the same way as the arm 104, but, in this case, the arms 134 and 135 are designed to move toward and away from the sheets being handled during welding so as to clamp the sheets between the screws mounted in the arms. FIG. 28 shows the arms in open position, and in FIG. 29 they are in closed position. In all other respects, the structures of this clamping assembly coincide with the clamping assembly shown in FIGS. 22-24.

[0055] FIGS. 30-35 show lateral views of a clamping assembly with transverse bores to receive the clamping screws of the fastening accessories shown at 136, 137, 138 and 139 in FIG. 35. The mounts of these bores at the sides of the body 102 are undercut for assembling projecting guide bushings. Likewise, in the figures, it can be seen that the openings for the

ends of the shaft 123 are covered with lateral covers 140.

[0056] Although the present invention has been described making reference to specific examples of the invention itself, it is understood that any technician on the subject, using the information contained in the present description, claims and drawings, will be able to introduce any variations on the invention that will be included in the invention provided they correspond to the scope of the claims.